NAVAL RESEARCH LABORATORY

TECHNOLOGY LICENSING OPPORTUNITY

MINIATURE MICROBIAL FUEL CELLS

Advantages/Features

Operates via passive nutrient diffusion; no active pump required

Uses low-cost membranes compared to other MFCs

Capable of operation in a wide range of aerobic aqueous environments compared to other MFCs

High power density: up to 0.5 mW/cm3/cell

With booster circuit, long term power supply for autonomous sensors and LEDs

Applications

Environmental sensors

Waste water treatment and purification

Bioremediation and waste reduction

Renewable electricity from biomass

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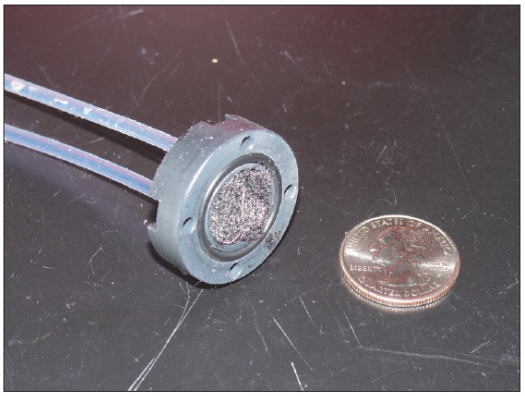
ENE01



Miniature MFC flow reactor with highest recorded power density of any MFC design.

Pumpless (passive diffusion) mini-MFC design with multiple cells linked in series.

The Naval Research Laboratory (NRL) has developed a novel microbial fuel cell (MFC) for harvesting energy from aerobic aqueous environments. It is powered by passive nutrient diffusion instead of energy-draining pumps used in other MFCs, thereby increasing the net energy output. The NRL design sequesters electrochemically active microbes in the cell, rather than relying on environmentally available bacteria. This allows the NRL MFC to be placed in a wide range of aerobic aqueous environments, not only in the bacteria's natural habitat at the sediment/water interface. Unlike other MFCs, which require relatively costly proton exchange membranes to maintain separation between protons and electrons, the NRL MFC uses inexpensive nanoporous membranes made from polycarbonate or other materials to confine the microbes. The resulting MFC designs are capable of generating microwatts to milliwatts, depending upon size (75 µL to 5 mL) and operating conditions (cathode catalyst, nutrients available, etc.). Many of the designs can be connected easily in series or in parallel for additional power generation. With the addition of a booster circuit, these MFCs can be used as a long term power supply for underwater autonomous sensors and LEDs.

References

"Diversifying Biological Fuel Cell Designs by Use of Nanoporous Filters," *Environmental Science and Technology* **41** (2007) 1444-1449.

"High power density from a miniature microbial fuel cell using *Shewanella oneidensis* DSP10," *Environmental Science and Technology* **40** (8): 2629-2634 (2006).

"A Biofilm Enhanced Miniature Microbial Fuel Cell Using *Shewanella oneidensis* DSP10 and Oxygen Reduction Cathodes," *Biosensors and Bioelectronics* **22** (2007) 1672-1679.

Available for License: US Patent No. 8,048,547 and US Patent Publication No. 2007-0048577.